

STANDARDS FOR ELECTIONS: PAST, PRESENT AND FUTURE

by

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1. Historical Source of the Federal Standards

After pre-scored punched cards, i.e., punched cards of the "votomatic" type, began to be used as ballots in elections in southern California in 1968, concern was raised by observers about the ability of the cards to record voters' choices accurately and in a permanent manner. It was reported as early as a primary in June, 1970, that "when ballot inspectors would fan a two-inch deck of ballot cards after receiving them, clouds of chad would fall out." However, an issue that loomed larger than chad was the possibility of computer program manipulation. A page-one story in The Los Angeles Times in 1969 had begun the controversy by reporting views of certain computer scientists that computer programs for vote-counting could be secretly manipulated to generate incorrect results. Several official investigations in the Los Angeles area were begun and a number of recommendations were produced about how vote-counting operations should proceed to prevent such fraud from being perpetrated and to assure public confidence in the reported election results. The issue was not put to rest, however.

Following a request from a member of Congress believed to be Senator Tunney of California, the US General Accounting Office (GAO), in 1973, called on the National Bureau of Standards (NBS) to undertake "a systems analysis and evaluation conducted on the role of automatic digital processing in vote-tallying." The funds for the study were provided by the GAO through its Office of Federal Elections (OFE). The NBS study, "Effective Use of Computing Technology in Vote-Tallying," published in 1975, would be cited later by the independent FEC (which replaced the OFE) as "[laying] the groundwork for the [Voting Systems] Standards' development." The NBS report had called for Statewide specifications for all computer programs employed in an election system, and for accuracy and security guidelines that would be uniform in all Statewide applications.

In January, 1980, partly as a result of the 1975 report, Congress adopted P.L. 96-187, Section 302, which called on the FEC, "with the cooperation and assistance of the NBS" to conduct a preliminary study and report on the feasibility of developing voluntary engineering and procedural performance standards for voting systems. Actually, because the costs of the study were mandated to be "paid out of any funds otherwise available to defray the expenses of the

Commission," and no funds had been specifically appropriated for NBS for the study, NBS did not participate significantly. The study was primarily undertaken by Robert J. Naegele, a private contractor for the FEC residing in California, who subsequently and admirably served the State of California in testing voting equipment for use in that state. The study, completed in 1983, concluded that "performance standards for voting systems are both needed and feasible."

In 1984, Congress approved an FEC budget that included money for standards development and the development process slowly began. However, in 1985, another controversy emerged about possible computer program manipulation. On July 29, 1985, The New York Times published a page-one story headlined "Computerized Systems for Voting Seen as Vulnerable to Tampering." The story, and follow-on articles, cited on-going lawsuits by several defeated candidates who claimed that the computer program used for tallying the results of elections using pre-scored punch card ballots could have been manipulated to cause their respective defeats. None of the lawsuits were concluded successfully by the plaintiffs and no computer program manipulation was ever demonstrated to the satisfaction of the courts hearing the cases. The effect of the stories on public policy was negligible at the time, although the situation did result in issuance of grants from the John and Mary R. Markle Foundation of New York City to examine the situation, and it resulted also in a study undertaken independently by the Office of the Attorney General of California in 1986. The report of the latter concluded that "all electronic vote tallying systems [should] have reliable, tamper-proof audit trails." The concern about audit-trails remains pertinent today, particularly in the use of DRE voting systems that do not employ hard-copy ballots and thereby include no voter-created documents that provide independent evidence if a recount is undertaken.

2. The First Set of Federal Standards

The first set of standards that were finally issued by the FEC in 1990 concerned only voting equipment, not complete voting systems. Even if it were desired to make the standards mandatory (and there was considerable opposition to this idea), this could not be done. The standards would have to be voluntary since there was no basis in Federal law for making them mandatory. While the term "systems" appears in the standards' title, the use of the word was questionable. A voting system involves, in addition to equipment, voters, poll-workers and administrators, and all of the procedures that are used to establish the voting process, record the voters' choices and disseminate the summarized results with provable accuracy and integrity.

The first set of standards was developed with significant input from election equipment vendors. There were no independent assessments available from outside the industry detailing what could be achieved by equipment, or what should be demanded of a computerized voting system in which the public could have confidence. Standards were established by consensus of what was achievable by available voting equipment without additional improvements.

This pragmatic development process had mixed results: some good outcomes and some not so good ones. At least two of these outcomes can be discerned from the impact of the standards on the Presidential election in Florida in November, 2000. A good outcome demonstrated in Florida

was that there were no serious concerns raised about the accuracy of the computer programs that counted the votes. Since the computer programs that were used in Florida were tested beforehand by the Independent Testing Authority established under the standards through the efforts of the National Association of State Election Directors, there should not have been any genuine concern without a detailed examination of the procedures used for software testing and handling. No such detailed and independent examinations have been reported. However, the difficulties with the pre-scored punch card ballots, which made "chad" a household word, may be seen as a glaring failure of the standards to adequately cover that area of technology.

The standards state (section 3.2.4.1.2) that "Punching devices shall ensure that the chad (debris) is completely removed." No punching device for pre-scored punch card ballots that does not include spring-loading to provide the extra mechanical leverage needed to completely punch out chad can carry out this requirement by itself. None of the punching devices in use in Florida in November, 2000, had any spring-loading. Complete removal of all the chad with this voting system requires the active involvement of the voter, and many voters simply failed in that election (and in most previous elections throughout the nation using pre-scored punch card ballots) to carry out the instruction to remove the chad from the back of the ballot card.

The standards also specified the "reading accuracy" (section 3.2.5.2.1) required to be achieved by the read heads in response to vote punches (for punch card systems) and marks (for optical scan systems), and

"to discriminate between valid punches or marks and extraneous perforations, smudges, and folds. ... That is, valid punches or marks shall be detected, invalid punches or marks shall be rejected, and no detection signal shall be accepted in the absence of a valid punch or mark. ... The error rate measured by this criterion shall not exceed one part in one million."

Puzzled citizens approached this author - following the November, 2000, election and after the difficulties in discerning "voter's intent" were widely reported - with the following question: If there were standards in place for computerized voting equipment, how could the ambiguous results, requiring examiners with magnifying glasses to determine "voter's intent," have occurred? Of course, ordinary citizens were not aware of the "one part in one million" requirement, but they intuitively knew that there was an inherent contradiction that made the USA, with its vaunted technical capability and its worldwide promotion of democracy among third-world nations, the laughingstock of other democratic countries.

The answer to their question was, even if the "votomatic-type" punch-card ballot system was "grandfathered" in Florida under the voting system standards, that the standards only applied to ballots perfectly punched and perfectly marked by machine, not to ballots punched and marked by real live voters with all the physical and mental limitations, as well as emotional blocks, that real live voters bring with them when confronting an unfamiliar mechanism of information technology.

There was no intention in the standards to consider the human element in its "Punch and Mark

Recording Subsystem." However, the 1975 NBS report that the FEC cites as "laying the groundwork for the standards' development" called for "research into human engineering of voting systems." It stated that (Section VIII B):

"since voting systems are used by the general public, a great majority of whom are not technically trained, it is important that these systems be designed for the ease of the user. ... Research results, both into the technical aspects of system design and the human engineering aspects, would be extremely valuable for States to obtain."

No research into human factors in the vote-casting situation has ever been seriously funded. It is only since the debacle of November, 2000, has the idea of applying behavioral psychology and the science of human -computer interaction to the voting process acquired some importance among decision-makers and grant-issuers.

3. The Second Set of Standards

The second set of Federal standards, now in draft, is more complete and detailed than the first set, and the standards provide some understanding of their own limitations. Nevertheless, the OEA should be pleased with what it has achieved, given the severe restrictions in resources at its disposal. The draft identifies what is missing, and awareness is the first step to improvement.

For example, the standards state specifically, in the Overview section, that "Administrative Functions" and "Detailed Human Interface and Usability Standards" are not included. The first set of standards provided no such identification of a road-map to further improvements.

However, in Section 1 - Introduction, it is stated that "the Standards should not force vendors to price their voting systems out of the range of local jurisdictions." This statement indicates an attitude which must be altered now and for the future; it expresses the view of the financing of voting systems that led to the debacle of November, 2000. The attitude presented in this sentence implies that (1) local governments are solely responsible for the costs of voting systems, and (2) local governments are so poor and election funding has such low priority that citizens must accept the lowest possible levels of accuracy, integrity, security, reliability and voter-friendliness in elections consistent with the grudging stinginess of penurious local governments.

The soul-searching that has gone on in this country since November, 2000, has resulted in the reversal of this attitude. Eight or so national study reports, produced by prestigious and knowledgeable organizations in 2001, have been nearly unanimous in their recommendations that the Federal government needs to be more involved by providing significant funding for election equipment and administration, and that State governments need to reclaim some of the responsibilities that they have pushed off to local governments by establishing Statewide uniformity and higher levels of public trust.

The following should be the new attitude: standards should be established that balance risk and

cost. By risk is meant the possibility that poor performance of voting equipment and poor implementation of administrative procedures will result in losses of accuracy, integrity, security and reliability, and provide too low a level of voter-friendliness. The public needs confidence that the election results produced do indeed accurately represent the collective choices of the voters, and voting equipment and the associated procedures must have performance characteristics that assure public confidence. Voting systems need not be gold-plated, but they must have the essentially required features.

4. Future Sets of Federal Standards

4.1 Priorities:

I envision two important thrusts, among others, for future expansion of the standards.

4.1.1 Human Factors Standards: Reductions in voter error rate need to be achieved. By voter error is meant a mistaken choice by a voter, i.e., an overvote, an unintended undervote, or a mis-selection. Considerable research needs to be undertaken to determine how mistaken choices can be avoided by better ballot and voting machine display designs, and by voter training. Such research may determine what levels of voter errors can be expected with different interventions. The results may be difficult to apply, since analysis to this point already indicates that human errors in vote-casting correlate inversely with education and other factors of socio-economic status. As an alternative to specifying a maximally acceptable voter error rate, it may be possible to specify design criteria that must be applied in ballot design for presentation to voters to minimize human error. That is, in this case, while it is most desirable to specify a quantitative performance level, that may not be possible. In such a situation, it may be useful, even if less desirable, to specify design standards that have been shown to be efficacious.

Note that this first thrust requires application of the sciences of behavioral psychology and computer-human interaction.

4.1.2 Integrity of Paperless Voting Systems: With the increasing use of paperless voting systems, more consideration must be given to assuring integrity in such systems. Application and systems software must be proven to be correct, and the software used must be assured to be the exact software tested. Hardware and software standards are needed that assure that once electronic ballot choices are entered and finalized by a voter, those data are identically and permanently recorded and cannot be changed, replaced or written over. Standards for administrative procedures are clearly needed, also. Additionally, DRE equipment must be tested in an environment in which paper test ballots cannot be used. Easy methods of exercising any unit against many test electronic ballots must be implemented and standardized. Furthermore, an effective substitute for a paper audit trail must be devised and employed that will meet the requirements of a detailed examination by representatives of defeated candidates. It may be that research will bring to light new methods of assuring that a result generated by any DRE unit exactly represents the choices intended to be entered by the voters.

This second priority must employ techniques devised by computer scientists and internal auditors, and must specify procedures.

4.1.3 Selection of the Appropriate Contractors: Neither priority mentioned

here involves the science of precise measurement of the properties of physical materials, or the establishment of interface standards that permit competing products to substitute for one another. While there may be subjects of standards in which such competencies may be valuable, these two priorities do not require that expertise. It is hoped that the OEA or its successor agency will have the resources and the independence to select the most appropriate organizations to carry out this necessary work.

4.2 Impact of Public Law: Another issue in development of the Federal standards concerns how the national voluntary industrial standards committees shall be involved. It seems clear that there is a strong interest of professional societies of engineers and others to be involved, on a pro-bono basis.

However, it is necessary to point out that standards for election equipment and procedures have as much in common with standards for public health and public safety as they have in common with standards for consumer products. As in public health and public safety, we are working in an area in which public law has a significant input. We must assure that the requirements of Amendment XIV to the Constitution and all the laws which depend on that amendment are met. We must assure that the requirements of the Voting Rights Act of 1965 and the National Voter Registration Act of 1993 are met. We must assure that procedures to be standardized and documentation to be retained provide the necessary assistance to law enforcement in case there is a concern that laws against election fraud, either Federal or State, have been violated. In addition, we can expect that an election reform act adopted by Congress in the near future may impose requirements on audit trails, voter error, and similar aspects of elections.

Given this understanding that we are working to implement a democratic process mandated by law, this author envisions three kinds of standards that may be employed for election equipment and administration.

4.3 Interface or Input-Output Standards

4.3.1 Process: Representatives of an industry group, made up of manufacturers of a product (competitive among themselves) meet with representatives of another industry group, made up of competitive users of the product. They may meet under the auspices of a standards-setting organization. They agree on mechanical, electrical, and information-transfer interfaces, such that any brand of manufactured product can work with any brand of using equipment.

4.3.2 Example: With a standardized type of information format and standardized mechanical construction, any brand of video cassette will fit into the slot of any brand of video cassette recorder, such that the tape will run correctly, and the information recorded will be presented correctly for viewing on the attached TV monitor.

4.3.3 Application to Elections: States will develop databases of voter registrations. Representatives of all states will meet together to establish formats for data interchange among databases so that, as voters move between states, registration in the state from which they moved may be appropriately canceled. The OEA could serve as a convener and keeper of format standards.

4.4 Specification of Quantitative Performance Requirements

4.4.1 Process: An organization with mission authority, e.g., the US Dept. of Defense or US Food and Drug Administration, determines that its mission, i.e., military security or public health, requires that values of a certain parameter of a particular product must fall within a certain range. It determines this range by processes of analysis, research, experimentation and possibly prototype development. The organization exercises its authority with purchasing discretion or regulatory actions.

4.4.2 Example: A State Board of Health requires that public water supplies meet certain criteria with regard to bacterial content. It may exercise its authority by shutting down a water supply or requiring that corrective actions be taken immediately.

4.4.3 Application to Elections: Through funding of analysis, research, experimentation and prototype development, the Federal Office of Election Administration could determine that a certain type of voter error in candidate choice should not exceed a particular value. It makes these efforts and results available to States, which may impose stricter certification requirements on voting equipment, require different ballot designs or de-certify certain types of equipment.

4.5 Implementation of Professional Best Practice

4.5.1 Process: A society of professionals, e.g., of accountants, fire-prevention professionals, industrial risk-reduction professionals, internal auditors, lawyers, etc., using methods of discussion and consensus, prepares and publishes guidelines for practitioners detailing best practices. Practitioners who fail to abide by these guidelines may find themselves open to lawsuits, criminal prosecution, or to loss of licenses or loss of professional standing.

4.5.2 Example: An accountant misstates the net worth of a corporation. Minority shareholders who believe they have been cheated sue the accounting firm.

4.5.3 Application to Elections: The OEA hires software and security professionals to examine the handling of software and security in election administration. Their recommendations are converted into a manual of best practice and become part of the voting system standards. In this case, while it would be more desirable to specify a required level of performance, inability to quantify may require that best practices be used as a substitute.

5. Benefits of this Workshop

This workshop has brought together professionals with a wider range of interests and competencies than have been involved with previous discussions of Federal standards. The presentations and interactions have made the knowledge bases of various disciplines and experiences available to others. In that sense, the workshop has been extremely valuable. I look forward to additional workshops with similar agendas in the near future.